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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/955,388	09/17/2001	Yoo-Sang Hwang	9898-189	9987

7590 12/16/2002

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EXAMINER

MAI, ANH D

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 12/16/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/955,388

Applicant(s)

HWANG ET AL.

Examiner

Anh D. Mai

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 October 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) 1-4 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 5-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Amendment

1. Amendment filed October 2, 2002 has been entered as Paper No. 5. Claim 5 have been amended. Claims 13-15 have been added. Claims 1-4 have been withdrawn. Claims 1-15 are pending.

Response to Amendment

2. The amendment filed October 2, 2002 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: "wherein the first sub-plug fills a lower portion of the contact hole to a level substantially below a top surface of the insulating layer".

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 5-15 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There does not appear to be a written description of the claim limitation “wherein the first sub-plug fills a lower portion of the contact hole to a level *substantially below a top surface of the insulating layer*” in the application as filed.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 5-8, 10-12 and 14 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Lim et al. (U.S. Patent No. 6,380,084) (cited previously).

With respect to claim 5, as best understood by the examiner, Lim teaches a method for manufacturing a semiconductor device as claimed including:

forming an insulating layer (52) having a contact hole therethrough on a semiconductor substrate (40);

forming a diffusion barrier layer (56/60) on a surface of insulating layer (52) and on surfaces within the contact hole; and

forming a contact plug in the contact hole by forming a first sub-plug (64) that fills a lower portion of the contact hole and forming a second sub-plug (68) that fills an upper portion of the contact hole on the first sub-plug (64),

wherein the first sub-plug (64) fill the lower portion of the contact hole to a level substantially below a top surface of the insulating layer. (See Figs. 15-16).

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With respect to claim 6, the formation of the first sub-plug (64) of Linn comprises forming a first metal layer (64) on the insulating layer (52) having the contact hole (66) therethrough and etching back the first metal layer (64) to a predetermined depth (85) to expose a void in the first metal layer, if any.

With respect to claims 7 and 8, the formation of the second sub-plug (68) of Lin comprises forming a second metal layer (68) on the semiconductor substrate on which the first sub-plug (64) has been formed and polishing the second metal layer (68) so as to expose a top surface of the diffusion barrier layer (56/60) on the insulating layer (52).

With respect to claim 10, the second sub-plug of Linn is formed of a material as claimed.

With respect to claim 11, the second sub-plug (68) is formed to a thickness as claimed.

With respect to claim 12, the diffusion barrier layer (56/60) is formed of a material as claimed.

With respect to claim 14, since the first metal layer (64) may also be deposited by CVD, thus the metal layer (64) is capable of generating a void.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 9 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Linn '084 as applied to claim 5 above, and further in view of Lee et al. (U.S. Patent No. 5,801,096).

With respect to claim 9, Lim formed the first sub-plug (64).

Thus, Lim is shown to teach all the features of the claim with the exception of using tungsten.

However, Lee teaches that using tungsten (10/16) to fill the contact plug (9) are well known in the art to form a conductive plug.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the first sub-plug (64) of Lim using tungsten as taught by Lee to provide electrical contact to the lower portion of the semiconductor substrate.

With respect to claim 13, the contact plug formed in the contact hole of Lim, in view of Lee, can be made to contact surface of the semiconductor substrate (1).

6. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lim '084 as applied to claim 8 above, and further in view of Grill et al. (U.S. Pub. No. 2002/0127844).

Lim teaches depositing a second metal layer (68) filling the upper portion of the contact plug.

Thus, Lim is shown to teach all the features of the claim with the exception of explicitly using atomic layer deposition.

However, Grill in a method for making a semiconductor device teaches: a conductive materials may be formed by various method well known to those skilled in the art including: CVD, plating and atomic layer deposition. (See [0042]).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the second metal layer (68) of Lim using atomic layer deposition as taught by Grill to avoid a defect such as a seam formation in the conductive layer.

Response to Arguments

7. Applicant's arguments with respect to claims 5-12 have been considered but are moot in view of the new ground(s) of rejection.

Although the same references applied, the arguments are moot because new limitations have been added to the claims.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

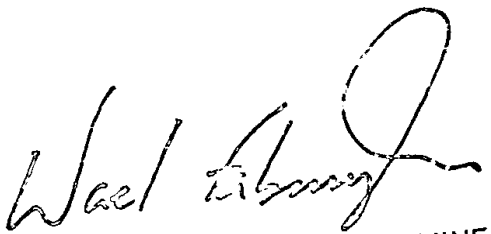
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
December 9, 2002


SUPERVISORY PRIMARY EXAMINER
TECHNOLOGY CENTER 2800